Science and Practice: living apart (but in the future more) together?

The digital or virtual revolution is creating many new opportunities and threats for science when it comes to incorporating practical knowledge, especially in cases with an information-evolution-complexity perspective.

There are differences between science and practice. Scientific knowledge contains specific characteristics: it is true justified belief. But know-how - as practical and tacit knowledge is sometimes called - is tested and (if successful) useful or valuable too. Both use trial and error; a method of falsification. However science is based on methodology; it is a method of compressing data (such as $e = mc^2$). Modern science emerged from practice and experimentation: “The most wonderful discovery made by scientists is science itself” (Jacob Bronowski). After this “discovery”, science and practice both went their own way. However, although it is sometimes asserted that scientists operate in an ivory tower, science is embedded in society: “There is nothing so practical as a good theory” (Kurt Lewin). Government policy nowadays is aimed at bridging the differences by way of valorisation: to push science to a more useful/valuable and economic driven research agenda (as if we are able to predict the kind of knowledge that is useful in the future).

But maybe the boundaries between science and practice will be less sharp in the digital and virtual revolution. This does not imply that we should remove the barriers between know-why and know-how, but that the differences will become more blurred. This is reminiscent of the early days of the scientific revolution (for a nice introduction in Dutch: “Kleine geschiedenis van de wetenschap”, Rienk Vermij). These renewed dense exchanges between science and practice open the doors to new opportunities and threats.

In the early days of the scientific revolution, practice and science were not clearly separated. Lots of experimentation and trial and error occurred. The microscope and telescope (both created by practitioners/entrepreneurs – van Leeuwenhoek and Lipperhey) revealed the inner world of creatures and the outer world of the universe. These technological devices opened the “Book of nature”. These dense interactions between science and practice seem to have diminished in the nineteenth and twentieth century but, as already stated, the connection between them could be restored again if new technologies create opportunities to open the “Book of complexity” introduced in the nineteenth en twentieth century by Darwin, Einstein, Gödel, Bohr and Heisenberg.

In the digital age the boundaries between science and practice will become more fluid because we can manipulate, share and incorporate information and knowledge much more easily. “When information is carried by things – it goes where the things go and no further. But once everyone is connected electronically, information can travel by itself.” (Evans and Wuster, 1997). Due to the triumph of bits, people can specialise, (re)use and (re)combine other information/knowledge in extreme ways. When experimentation, modification and innovation is successful it is more easily noticed, transferred, and incorporated in other directions/applications (increasing the number of citations, or the impact factor, reinforcing future citations). Digital hobbyists are usually very focussed, and extremely specialised. In the modular digital age it will be easier to accommodate their findings in science, thus creating new methods/technologies for troubleshooting. These new ways of scientifically using practical data generating or data compressing technologies resemble the influence of the new technologies of Van Leeuwenhoek and Lipperhey in the seventeenth century. They open up new ways of creating data for testing theories or finding solutions for data in search of a

theory (just like Johannes Kepler compressed the data of Tycho Brahe); and finally to a better and deeper understanding of the complexity of life.

New research methods are and will be used: data mining, mapping, simulating, designing, creating, combining, collecting, and disclosing. This requires a more artistic and creative perspective, a context of discovery, versus the classic, conservative, methodological perspective in the context of justification. Lots of scientists nowadays use the general public to generate problems, ideas, interpret pictures, language and maps (e.g. “mapsinthecrowd”), or to collect data in this so-called citizen or networked science. Scientists can create artificial societies, just like gamers do. A group of video gamers recently published an article in the Journal of Molecular Biology about RNA molecules. They used a serious game (Eterna) that gamers use to solve scientific problems (De Volkskrant, 25 February 2016). Another example is an article in the Geoscientific Instrumentation methods and data system – I can imagine that you have never heard about this journal, neither had I. A hobbyist developed a special device with sensors to collect data about water temperature designed to measure water flows (De Volkskrant, 1 March 2016).

Digitalisation makes disclosure easier – internet is the modern Gutenberg - the public can participate not only in collecting data, but also in recombining data. Via open source platforms and apps the public can participate in research easily, with low costs and barriers. Scientific knowledge chains with strong and weak (practical) ties will self-organise in a legal and political institutional framework, just like value chains in the business ecology.

Of course there are downsides to this developing digital knowledge landscape. Data mining can create an explosion of meaningless correlations. It could even undermine the standard pillars of empirical science with assumed normal distributions. Maybe statistical tools applied to these ‘normal’ situations do not apply because of power laws. Besides, data can be manipulated. How to distinguish between facts, figures, fakes, fiction and myths? What are the checks and balances for monitoring and governing data and for generating data with public assistance? Who stores and has access to the data and may use it – for what reasons (even for making a profit)? Should data be disclosed for reproduction? How to cope with personnel data? Universities try to introduce data management protocols – partly because of scandals in the past - to cope with these problems.

This blog is no plea for removing barriers between science and practice; however the difference will become more blurred. It is also not a plea for market driven research – it is rather silly to assume that we already know what is useful. It is no plea for abolishing monodisciplinary research; specialisation is very important, but integrating it too. It is a plea for considering and imagining the consequences of this flux (scientific) knowledge world. After all: “The true sign of intelligence is not knowledge but imagination”. (Albert Einstein).